CLAIMS:

1. A system for use in the detection or measurement of at least one characteristic relating to a chemical environment, the system comprising:

an optical fibre arranged to receive light from an optical source;

the system being adapted to let a gas derived from said chemical environment diffuse into the optical fibre thereby altering the optical properties of the optical fibre, so that changes in the optical properties of the optical fibre due to the in-diffusion of said gas can be determined by optical signal detection and signal analysing means for deriving from the determined changes at least one characteristic value representing the chemical environment.

2. A system according to claim 1, comprising reaction elements or catalysts adapted to react or interact with constituents of the chemical environment so as to create said gas.

3. A system according to claim 2, wherein the reactive element(s) or catalyst(s) is/are added to or on the outside of the fibre coating of the optical fibre.

4. A system according to claim 2, wherein the reactive element(s) or catalyst(s) is/are added to or on the outside of a tube element provided for protection and packaging of the optical fibre.

5. A system according to any of claims 2 to 4, wherein the one or more reactive elements or catalysts comprises metals.

6. A system according to any of claims 2 to 5, wherein the one or more reactive elements or catalysts comprises elements capable of undergoing a chemical reaction, such as a corrosion process, thereby generating said gas.

7. A system according to claim 6, wherein the one or more reactive elements or catalysts comprises iron, the iron generating said gas, whereby a value representing the ingress of water and the start of a corrosion process can be derived from the determined changes.

8. A system according to claim 6, wherein the metal elements comprises zinc, the zinc generating said gas, whereby a pH-value representing the chemical environment can be derived from the determined changes.

9. A system according to claim 5, wherein the metal elements comprises magnesium, in order to enable the detection or measurement of carbon dioxide by detection or measurement of the hydrogen formed during a reaction process including the carbon dioxide and metal elements.

10. A system according to claim 6, wherein the metal elements comprises zinc, in order to enable the detection or measurement of hydrogen sulfide by detection of the hydrogen gas formed in a reaction process including the hydrogen sulfide and the metal elements.

11. A system according to one of the preceding claims, wherein the in-diffusion of said gas causes an additional loss in the light transmitted in the optical fibre.

12. A system according to any of the preceding claims, wherein the change in the optical properties of the optical fibre is enhanced by suitable dopants in the fibre, e.g. germanium or phosphorous.

13. A system according to any of the preceding claims, wherein the fibre is coated with a coating comprising a material with high diffusivity to the gas.

14. A system according to claim 13, wherein the coating comprises polymers with high diffusivity to gas.

15. A system according to any one of the preceding claims, further comprising inlet means arranged to allow a sample or part of the chemical environment to enter the system.

16. A system according to claim 2, or any of claims 3 to 15 as directly or indirectly dependent on claim 2, wherein the one or more reaction elements contribute to the galvanic protection of metal armouring.

17. A system according to any preceding claim, wherein the gas is hydrogen.

18. A system according to any preceding claim, further comprising a light source for launching light into the optical fibre.

19. A sensor system comprising a system according to any preceding claim, and optical signal detection and signal analysing means adapted to determine said changes in the optical properties of the optical fibre and to derive from the determined changes said at least one characteristic value.

20. A sensor system according to claim 19 as dependent on claim 11 or on any of claims 12 to 18 as directly or indirectly dependent on claim 11, further comprising optical transmission measurement means for obtaining a measure of the additional loss by measuring the transmission loss of the optical fibre.

21. A sensor system according to claim 20, or according to claim 19 as dependent on claim 11 or on any of claims 12 to 18 as directly or indirectly dependent on claim 11, comprising optical measurement means for determining the magnitude and location of the additional losses along the fibre.

22. A sensor system according to claim 21, wherein the optical measurement means comprises an OTDR (Optical Time Domain Reflection) apparatus.

23. A sensor system according to claim 20, 21 or 22, further comprising optical measurement means for measurement of at least two optical wavelengths, the first optical wavelength being within an absorption peak caused by the gas, the second optical wavelength being outside the absorption peak caused by the gas, the sensor system further comprising comparison means for comparing the measurements at said at

least two wavelengths in order to compensate for losses caused by mechanisms other than in-diffusion of the gas.

24. A sensor system according to claim 23, wherein the comparison means is arranged to compensate for losses caused by bending of the fibre.

25. A sensor system according to claim 23 or 24, wherein the first peak is at 1244 nm and the second peak at about 1300 nm.

26. A sensor system according to claim 19, wherein the optical fibre comprises one or more FBG (Fibre Bragg grating)-elements, the Bragg wavelength of the Bragg grating(s) depending on the in-diffusion of said gas, and wherein the optical detection and signal analysing means comprises means for measuring the shift of the reflected Bragg wavelength of at least one of the FBG elements due to the in-diffusion of said gas.

27. A sensor system according to claim 26, comprising means for compensating for wavelength changes caused by mechanisms other than in-diffusion of the gas.

28. A sensor system according to claim 27, wherein the compensating means is arranged to compensate for temperature changes.

29. A sensor system according to claim 27 or 28, wherein at least two FBGs are provided, and the compensating means is arranged to measure the reflected Bragg wavelengths of the at least two FBGs, wherein at least one FBG is exposed to the gas and at least one other FBG is protected from the gas.

30. A sensor system according to claim 29, wherein a carbon layer is provided for protection of said other FBG.

31. A sensor system according to claim 29 or 30, wherein the at least two FBGs are closely spaced.

32. A detection or measurement assembly for use with a system of any of claims 1 to 18 or in a sensor system according to any of claims 19 to 31, the assembly comprising:

optical signal detection and signal analysing means arranged to determine changes in the optical properties of the optical fibre due to the in-diffusion of the said gas, and to derive from the determined changes at least one characteristic value representing the chemical environment.

33. Use of a system, a sensor system or an assembly according to any one of the preceding claims as a sensor for monitoring the corrosion and/or the environmental conditions of flexible risers in offshore environments.

34. A method of detecting or measuring at least one characteristic relating to a chemical environment, comprising:

launching light into an optical fibre;

letting a gas derived from the chemical environment diffuse into the optical fibre, thereby altering the optical properties of the optical fibre;

detecting and analysing light from the optical fibre so as to determine changes in the optical properties of the optical fibre due to the in-diffusion of said gas; and

deriving said at least one characteristic value representing the chemical environment from the determined changes.